

$$\frac{\partial}{\partial t} \left( \frac{\partial \mathcal{L}}{\partial \dot{\mathbf{q}}} \right) = \frac{\partial \mathcal{L}}{\partial \mathbf{q}} \quad \text{and} \quad \frac{\partial \mathcal{L}}{\partial \mathbf{q}} = -\frac{\partial \mathcal{L}}{\partial \mathbf{p}}$$

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